

New claims 22-30 have been inserted.

Claims 13-21 were rejected under 35 USC §103(a) as being unpatentable over FEYGIN 5,354,414, in view of DECKARD 5,639,070, and Dictionary of Ceramic Science and Engineering. Applicants respectfully traverse this rejection.

Claim 13 has been amended to recite "to create grain joints between particles of said powder or said mixture of powders" and "repeating steps 2 to 4 while maintaining said heating". Bases for the amendments to claim 13 are found at page 7, lines 16-18 and page 13, lines 24-27 of the specification.

Claim 17 has been amended to recite "compacting said layer thereby increasing the density of said layer and decreasing porosity of said powder or said mixture of powders". Basis for the above amendment is found at page 7, lines 5-7 and page 8, lines 3-7 of the specification.

The claimed inventive process is directed to rapid prototyping by sintering in solid phase of any powder (claim 13), and particularly ceramic powders (claim 14).

FEYGIN describes a process for rapid prototyping with a laser beam which changes the physical or chemical properties of the powders. FEYGIN does not disclose that the sintering is in solid phase.

Even if FEYGIN uses the word "sintering", his use of the word does not correspond to the definition set forth in the

Dictionary of Ceramic Science and Engineering and further his "sintering" is not that recited.

At column 6, lines 2-7 of FEYGIN, it is stated that "The powder affected by the laser beam changes its physical or chemical properties. Most often this change results in sintering or melting of the powder and fusing the material within the boundaries of a cross-section as well as bonding it to the previous cross-section."

Applicants respectfully submit that the wording "sintering or melting and fusing" (underlining added) used by FEYGIN confirms that a liquid phase is produced.

In view of the above remarks, applicants submit that FEYGIN does not encompass a process of "sintering in solid phase", as required by the present claims.

According to applicants' claimed inventive process, the ceramic powder or the mixture of ceramic powders is heated before sintering to reduce the energy supplied by the laser for increasing the rapidity of production of the object.

DECKARD describes heating the layer of powder to be sintered prior to sintering.

At column 6, lines 38-45, DECKARD specifies "Undesirable shrinkage of the article being produced has been observed to occur due to differences between the temperature of the particles not yet scanned...and the previously scanned layer. It has been found that a downward flow of controlled-temperature

air through the target area is able to moderate such undesirable temperature differences."

DECKARD heats the powder not to reduce the energy supplied by the laser but to reduce the difference between the temperature of the powder not yet scanned and the temperature of the powder previously scanned.

Furthermore, like FEYGIN, DECKARD misuses the word "sintering". DECKARD describes sintering in liquid phase. See, for example, column 8, lines 1-5; "to fuse the powder" in claim 1; and "to provide ... the heat of fusion of the powder" in claim 2 of DECKARD.

Applicants respectfully submit that the inventive process of claims 13-21 would not have been obvious to one of ordinary skill in the art over FEYGIN in view of DECKARD and Dictionary of Ceramic Science and Engineering because neither FEYGIN nor DECKARD describe or render obvious "sintering in solid phase", as recited in applicants' claims.

Claim 13 recites "repeating steps 2 to 4 while maintaining said heating". In sharp contrast to the above recitation, DECKARD describes a step of heating after formation of a "sintered" first layer.

In view of the above amendments and remarks, applicants respectfully request reconsideration and withdrawal of the rejection of claims 13-21 under 35 USC §103(a) as being

unpatentable over FEYGIN in view of DECKARD and Dictionary of Ceramic Science and Engineering.

Applicants further submit that new claims 22-30 are also allowable over FEYGIN, DECKARD, Dictionary of Ceramic Science and Engineering, and any combination thereof.

Basis for the subject matter of claim 22 is found in Figure 2; page 10, line 9 - page 11, line 2; and page 13, lines 24-27 of the specification.

Basis for claims 23-27 is found in claims 17-21.

Basis for new claims 28-30 is found at page 7, lines 12-18 of the specification.

Applicants respectfully submit that none of the applied prior art references describe or render obvious to one of ordinary skill in the art step 2 of claim 22.

In view of the above amendments and remarks, applicants respectfully submit that new claims 22-30 are patentable over FEYGIN, DECKARD, Dictionary of Ceramic Science and Engineering, and any combination thereof.

In light of the amendments discussed above, applicants believe that the present application is in condition for allowance and an early indication of the same is respectfully requested.

If the Examiner has any questions or requests clarification of any of the above points, the Examiner may

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contact the undersigned agent so that this application may continue to be expeditiously advanced.

Attached hereto is a marked-up version of the changes made to the claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

YOUNG & THOMPSON

By



J. Reed Batten, Jr.
Agent for Applicants
Registration No. 27,099
745 South 23rd Street
Arlington, VA 22202
Telephone: 521-2297

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 13 was amended as follows:

--13. (amended) A process for the rapid prototyping by sintering in solid phase, with a laser, of a powder or a mixture of powders, comprising the steps of:

1/ obtaining a series of digitized superposed sections of an object to be produced, from a three-dimensional representation of said object;

2/ spreading the powder or mixture of powders in the form of a thin layer; [and]

3/ heating the layer [to] at a temperature near the sintering temperature in solid phase of said powder or said mixture of powders;

[3/] 4/ bringing the heated layer to the solid phase sintering temperature to create grain joints between particles of said powder or said mixture of powders by sweeping with a laser beam said layer such that a selected portion of the powder, which corresponds to one of the digitized sections of the object to be produced, is sintered in solid phase by the supplemental energy supplied by the laser[,]; and

repeating steps 2 [and 3] to 4 while maintaining said heating until all the digitized superposed sections of the object to be produced are obtained.-

Claim 17 was amended as follows:

--17. (amended) A process for the rapid prototyping by sintering in solid phase, with a laser, of a powder or a mixture of powders, comprising the steps of:

1/ obtaining a series of digitized superposed sections of an object to be produced, from a three-dimensional representation of said object;

2/ spreading the powder or mixture of powders in the form of a thin layer; [and]

3/ heating the layer to a temperature near the sintering temperature in solid phase of said powder or said mixture of powders;

[3/] 4/ compacting said layer thereby increasing the density of [the heated powder of the] said layer and decreasing porosity of said powder or said mixture of powders;

[4/] 5/ bringing the layer densified and heated [layer] to the sintering temperature by sweeping with a laser beam said layer such that a selected portion of the powder, which corresponds to one of the digitized sections of the object to be produced, is sintered in solid phase by the supplemental energy supplied by the laser; and

repeating steps 2[, 3 and 4] to 5 until all the digitized superposed sections of the object to be produced are obtained.--